Data Analysis Assignment #2 – Urban Hydrology – Due 18 April, 12:30 pm

Assignment Requirements

1. (100 points) **Test your hypothesis:** Go back to the hypotheses you generated near the beginning of the semester and identify the hypothesis that is possible to test based on the collected data. (If you need to be reminded of your hypotheses, let me know.)
    a. Using the data collected, test your hypothesis using tables, graphs, and statistics as appropriate.
        i. I've flagged a few pieces of clearly erroneous data in red in the spreadsheet, but you may want to do some additional quality control before completing your analysis. If you decide to remove some data, you will need to justify your choices.
        ii. In order to undertake your analyses, you may have to consider potential confounding (complicating) factors beyond your original focus. For example, if you hypothesized that the water would be warmer on Wednesdays, you might want to look at data on air temperature for Wednesdays versus the rest of the week.
        iii. You may also want to think about other possible sources of noise/error.
    b. Find at least 2 pieces of scientific literature (journal article, text book, or government document) that help you explain your results. This literature should not have been previously assigned for the class.
        i. Google Scholar (scholar.google.com) is one place to start, as are the databases available through the library (http://libguides.library.kent.edu/alpha). Of those, I find "Web of Science" to be particularly helpful.
        ii. There is also the tried-and-true method of looking at your assigned readings for class and looking at what papers they cite.
        iii. I can help you if you are stuck.
    c. Write a ~2 page analysis that includes the following sections:
        i. (10 pts) Hypothesis and Rationale (for your hypothesis, a restatement of your original idea)
        ii. (35 pts) Analysis of the Data (including at least one relevant graph or table, neatly formatted, labeled, and captioned)
        iii. (30 pts) Discussion (explain what your results mean, put them in the context of the scientific literature, and consider possible errors or confounding factors)(use parenthetical in-text citations of references)
        iv. (20 pts) Future Research Needs (Ideally, how would you collect and analyze data to test your hypothesis in the Cuyahoga River? To what additional questions does your analysis lead you?)
        v. (5 pts) References Cited, in the following format:
            1. Bernhardt, E.S., and Palmer, M.A., 2007, Restoring streams in an urbanizing world, *Freshwater Biology*, 52: 738–751.
            2. Lazaro, T.R., 1990, *Urban Hydrology*, CRC Press, Boca Raton., 264 p.
            3. Noble, R.D., and Jackman, A.P., 1984, *Meteorological, water-temperature, and discharge data for the Mattole River basin, Humboldt County, California*: U.S. Geological Survey Water-Resources Investigations Report 78-81, 93 p.

2. (45 points) **Stretch your skills:** Your hypothesis above likely focused on 1 of 3 things:

a. Differences across sites
b. Differences over time
c. Relationships between two variables

Identify which type of hypothesis you had, and then pick a different type of analysis to do with another part of the dataset. For example, if your hypothesis focused on looking at differences between sites, find something interesting in the data to analyze over time (for one or multiple sites). Analyze the data using graphs, tables, and statistics, as appropriate.

a. Write a 1-2 page analysis that describes your new research question (10 pts) and results (25 pts), including at least one informative and neatly organized graph or table (10 pts).
b. No literature review is required for this analysis.
c.

3. (5 points) **Be professional and courteous:** Turn in your assignment typed, stapled in the upper left corner, organized in a logical order, with your name on it, and all in one piece.

Graduate students: At least one of your analyses must include statistics beyond simple descriptive statistics (e.g., mean, standard deviation). Examples of appropriate statistics are t-test, ANOVA, correlation, and regression. After applying statistics, you should be able to tell me whether a result is statistically significant or not. If you have never had any statistics, I expect you to ask me for help.

What is a neatly formatted, labeled, and captioned graph?

It has 1 or more data series plotted with appropriate x- and y-axis scales (e.g., make a date axis go from ~2/5/13 to 3/15/13, use a xy or scatter plot). The x-axis of a graph is always your independent variable and the y-axis is the dependent variable. The axes are labeled, including units. There is a legend indicating the color/symbol for each data series. All fonts are legible and text is not overlapping or smooshed together. Number your figures and tables and reference them in the text. The caption should start with a sentence or sentence fragment that tells what the figure is. Subsequent sentences in the caption must be complete sentences. Look in the scientific literature for examples!

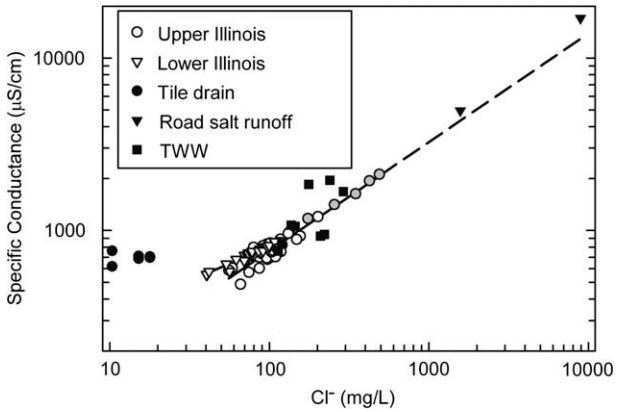

Fig. 6. Log–log plot of specific conductance vs. Cl^- concentrations for samples collected in this study. Solid lines are linear regressions of Upper Illinois and Lower Illinois Waterway samples; the dashed line is a continuation of the Upper Illinois regression. The gray circles are Upper Illinois samples collected in February 2004.

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Background: In this assignment you will be working with data collected earlier in the semester on the Cuyahoga River as it flows through Kent. Data were collected most days between February 6th and March 13, 2013 at 4 locations. Each student in the class was responsible for data collection on one day, after all students had received a brief orientation from the professor. Detailed methods and site descriptions are available in the Date Collection Assignment. The following parameters are reported in the "UH13Data.xlsx" spreadsheet in the course dropbox.

- Date – all measurements were made during daylight hours
- Weather notes – as reported by data collector
- Air Temperature at Main St Sampling Time (°C) – This is the air temperature recorded at the Kent State Geography weather station (on the top of McGilvrey Hall) at the time closest to the time recorded for the Main Street data collection. On a few occasions, data were not available from the Geography weather station, so the Kent Downtown station was used instead. On days when no data were collected, the average daily temperature is recorded for reference.
- Rain (mm) – as recorded at the Kent State Geography weather station. Some rain may have fallen before the data collection time, while other rain may have occurred later in the day.
- Approximate Snow Water Equivalent (mm) – Snow water equivalent (SWE) is the depth of water produced by melted snow. SWE and snow depth were recorded near downtown Kent at ~8 am each day, and SWE is attributed to the day before the measurement was made.
- Average Discharge at USGS gage in Hiram Rapids (m^3/s) – This is the daily average discharge at the USGS gage upstream of Kent on the Cuyahoga River. As with rain and snow, the daily average can be affected by storms happening late in the day and so may not be an exact representation of discharge at the time of sampling.
- The following data were collected at either 2 or 4 sites each day. The data are keyed by site.
    - Time of Data Collection (Note: Times were not adjusted for the change to Daylight Savings Time on 3/10/13)
    - Notes – as recorded by the data collector
    - Turbidity (cm) – visibility through the water column as measured in a transparency tube. High numbers indicate less turbid water.
    - Turbidity (NTU) – based on the calculation from the turbidity/visibility, reports turbidity in the standard Nephelometric Turbidity Units (NTUs). The conversion formula is given in the Data Collection Assignment details, and it would be good to convert all data <8 NTU to actual numbers.
    - Specific Conductance (μS/cm) – a measure of dissolved materials, recorded in the water column or a bucket
    - Temperature (°C) – recorded in the water column or a bucket